Urban Transport Mode’s “Publicity” Calculation Evaluation

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Abstract: Currently, different countries and regions have their own classification methods and standards defining urban public transport or the modes. These classification standards are adjusted over time as new means of transport and transport technologies arise. What the crucial is that government should judge advantage of the transport or the modes firstly, allow the use of public finances as a subsidy. This study considers the service excludability of urban transport (whether it is open to all residents) and the utilization efficiency of public resources (whether there is intensive land utilization of road space and time resources). The “publicity measurement” index is proposed for urban rail transit, the rapid transit bus, the conventional public bus (tram), the taxi, public bicycle, school bus, private compact car and other common transport modes. The “publicity measurement” index is calculated and analyzed to quantitatively characterize the “publicity” of different modes of transport.

Key words: Excludability, intensive land utilization, publicity measurement index

INTRODUCTION

After years of development, urban public transportation in China has made the progress but it also faces many problems (Wang, 2007a). These problems can directly affect residents’ understanding of the development and functionality of urban public transportation (Wang, 2007b). Subsequently, they have a practical effect on the prioritized development of urban public transportation to reduce transport congestion and promote urban development.

Currently, different countries and regions have their own classification methods and standards of defining urban public transport or the modes and select its urban public transport methods (MOC, 2004). These classification standards are adjusted over the time as new means of transport and transport technologies arise. Nevertheless, there is some consistency among the different definitions (MOC, 2006). For example, public transport should be more efficient than individual transport and its primary function is to provide intensive land utilization services for the public, rather than concern on the means of transport or transportation method (Chen et al., 2006). In addition, this public service should be led by a government or public institution to unify management (Liu et al., 2011). Government departments should clearly state the public transport market entry rules, operational service requirements, price verification and planning permission (Li et al., 2005). They should also freely provide some or all of the municipal public facilities, as well as allow (but not require) the use of public finances as a subsidy or allowance (Chen, 2008).

The important is that government should judge advantage of the transport or the modes firstly, allow the use of public finances as a subsidy (Xiong and Chen, 2009). It is not proper that the government give the public subsidy to all the urban public transport or the modes (Adler, 1980). Because it will lead to the problems on management, such as operational service requirements, price verification and so on (McGee, 2003).

This study considers the service excludability of urban transport (whether it is open to all residents) and the utilization efficiency of public resources (whether there is intensive land utilization of road space and time resources). The “publicity measurement” index is introduced for urban rail transit, the rapid transit bus, the conventional public bus (tram), the taxi, public bicycle, school bus, private compact car and other common transport modes. A “publicity measurement” index is calculated and analyzed to quantitatively characterize the “publicity” of different modes of transport.

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“PUBLICITY” MEASUREMENT AND CALCULATION

Measurement system based on “publicity”: The following is a brief introduction to the indicators used in the measurement index system for the “publicity” of urban transport.

Excludability index: The Excludability Index (EI) measures the degree of openness of a transport mode in providing public services to the community. The greater the value of the index is, the lower the level of excludability and vice versa will be. When EI = 1, the mode of transport is completely open to the public, when EI = 0, the public is fully excluded and when EI = 0.5, the mode of transport is partially open to the public. For example, public buses and trams have an EI value of 1, private cars have an EI value of 0 and school buses have an EI value of 0.5.

Level of intensive land utilization: The level of Intensive Land Utilization (ILU) indicates the passenger transportation efficiency of the transport mode per unit road (or track) area. The greater the value of the index, the higher level of intensive land utilization and vice versa. Assuming the ILU value of public buses and trams is 1, the ILU values of other modes of transport will be multiples of 1.

“Publicity” measurement index: The “publicity” measurement index for a transport mode is established using the excludability index and the ILU. The formula is shown in Eq 1:

\[ MPR = EI \times W1 + ILU \times W2 \]  \hspace{1cm} (1)

where, MPR is the measuring publicity ruler which indicates the “publicity” index of the transport mode, EI is the excludability index of the transport mode; ILU is the level of intensive land utilization of the transport mode, W1 is the weight of the excludability index and W2 is the weight of the ILU.

Analysis based on the “publicity” measurement Index

Excludability index analysis: Everybody can use the following modes as public bus, rail transit, bus rapid transit, public bicycle and taxi which are completely open to the public, so the value of the index is 1. The school bus is partially open to the public, so the value of the index is 0.5. The compact car is fully excluded to the public, so the value of the index is 0.

Table 1 shows the excludability indices for the various transport modes.

<table>
<thead>
<tr>
<th>Transport mode</th>
<th>Excludability index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public bus (tram)</td>
<td>1.0</td>
</tr>
<tr>
<td>Rail transit</td>
<td>1.0</td>
</tr>
<tr>
<td>Bus rapid transit</td>
<td>1.0</td>
</tr>
<tr>
<td>Public bicycle</td>
<td>1.0</td>
</tr>
<tr>
<td>Taxi</td>
<td>1.0</td>
</tr>
<tr>
<td>School bus</td>
<td>0.5</td>
</tr>
<tr>
<td>Compact car</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Table 2: Level of intensive land utilization of transport modes

<table>
<thead>
<tr>
<th>Transport mode</th>
<th>Level of intensive land utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail transit</td>
<td>15.00</td>
</tr>
<tr>
<td>Bus rapid transit</td>
<td>2.50</td>
</tr>
<tr>
<td>Public bus (tram)</td>
<td>1.00</td>
</tr>
<tr>
<td>School bus</td>
<td>0.80</td>
</tr>
<tr>
<td>Public bicycle</td>
<td>0.16</td>
</tr>
<tr>
<td>Taxi</td>
<td>0.05</td>
</tr>
<tr>
<td>Compact car</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Table 3: Combination of index weights

<table>
<thead>
<tr>
<th>Index</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excludability index, W1</td>
<td>0.7</td>
<td>0.6</td>
<td>0.8</td>
</tr>
<tr>
<td>Level of intensive land utilization</td>
<td>0.3</td>
<td>0.4</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Level of intensive land utilization analysis: The level of Intensive Land Utilization (ILU) indicates the passenger transportation efficiency of the transport mode per unit road (or track) area. Assuming the ILU value of public buses and trams is 1, the ILU values of other modes of transport will be multiples of 1.

Table 2 shows the ILU values for the various transport modes.

Index weights analysis: Three sets of index weights are used in this study to calculate and analyze the “publicity” of the different transport modes, as shown in Table 3.

DEFINITION OF PUBLIC TRANSPORT MODE BASED ON “PUBLICITY” MEASUREMENT

“Publicity” calculation results: Table 4 shows the “publicity” calculation results for three sets of transport modes based on Eq. 1 and Tables 1, 2, 3.

A comparison of the “publicity” values for the different transport modes, using the three sets of weight combinations, show uniform calculation results. The sequence of transport mode in terms of “publicity” is as follows: Rail transit, bus rapid transit, public bus (tram), public bicycle, taxi, school bus and compact car as shown in the Fig. 1-5.

The analysis of “publicity measurement” index calculation showed that, if conventional public
buses (tram) are used as a standard, then rail transport, rapid transit buses and public buses (trans) are undoubtedly public transport modes. The "publicity" value of the private compact car is close to zero which indicates it has a good identifiability. Worthy of discussion are the public bicycle, school bus and taxi. The "publicity" indices of these three transport modes are lower than public buses (tram) but significantly higher than private compact cars. These three modes play an important role in satisfying the travel needs of specific groups. They can also help to facilitate a smooth change of transportation travel behavior and promote the sustainable development of transportation. Therefore,

these transport modes should be considered as characteristic (or special) forms of public services and be adopted into the public transportation system to facilitate integrated management by the city government.

Where to position taxis is particularly important and is discussed here in more detail. Based on the above publicity measurement evaluation and the analysis of the priority of buses, it proposes the following macro development orientation to taxi transport:

- Taxi transport is a public transport service that can meet a specific time and space in travel demand, compensate for inadequate service of regular public transport services and have a positive effect in reducing and slowing the purchase of compact car
public transport or the modes to which urban public transport belong. These classification standards are adjusted over the time as new means of transport and transport technologies arise. What the crucial is that government should judge advantage of the transport or the modes firstly, allow the use of public finances as a subsidy. It cannot guarantee that the government gives the public subsidy to all the urban public transport or the modes. Because it will lead to the problems on management, such as operational service requirements, price verification and so on.

A “publicity measurement” index is calculated and analyzed to quantitatively characterize the “publicity” of different modes of transport in this study. It considers the service excludability of urban transport and the utilization efficiency of public resources. A comparison of the “publicity” values for the different transport modes, using the three sets of weight combinations, show uniform calculation results. The sequence of transport mode in terms of “publicity” is as follows: rail transit, bus rapid transit, public bus (tram), public bicycle, taxi, school bus and private compact car.

Especially, the public bicycle, school bus and taxi were controversial in the admin area. These transport modes should be considered as characteristic (or special) forms of public services and be adopted into the public transportation system to facilitate integrated management by the city government. Based on the above publicity measurement evaluation and the analysis of the priority of buses, it proposes some macro development orientation to taxi transport.

A “publicity measurement” index is proposed in this study. However, there is still room for improvement for future studies. Future studies should pay more attention to the following issues about the problem of management: public transport market entry rules, operational service requirements, price verification, planning permission and the subsidy mechanism.

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REFERENCES


CONCLUSION AND FUTURE RESEARCH

Different countries and regions have their own classification methods and standards defining urban

Fig. 5: “Publicity” calculation results

by families. Thus, it should be included in the government’s public transportation management field and its overall scale, growth rate, business model, pricing and so on, should be unified and managed by the government.

• The service quality provided by taxi transportation is the highest of the existing urban transport modes. It is faster and more comfortable than walking, cycling and regular public transport, it eliminates fatigue for individuals who would otherwise be driving and eliminates the trouble of finding parking spaces. The cost of using the taxi service should reflect the quality of its services. Low cost taxi usage would stimulate unreasonable travel demand and would have a negative impact on both the shaping of healthy travel behavior and the cumulative effect of implementing public transportation prioritizing policies.

• Taxi transport has a low efficiency in term of the usage of public resources. The reality of the constraint of “many people, fewer resources” has determined that taxi transport can not be included in the priority development target in China. The national authority should state clearly the orientation of the taxi development policy and strategy, control the development scale of taxis appropriately and plan and construct taxi stands and a unified management platform for the public to use free of charge. However, the wisdom of spending a huge amount of public finances to subsidize the cost of taxi operations (e.g., petrol) is debatable.